computing today

No 1

November 78

more on TRITON

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CUTS Card

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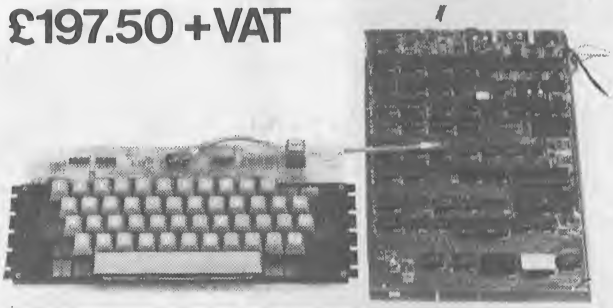

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Nascom Microcomputer's highly successful seminar is coming to Bristol. The programme will be similar to London and Manchester, both of which were sold out. The day includes five lectures, demonstrations and an open forum. Venue is the Dragonara Hotel, Bristol, Saturday, October 14th, 09.50 to 17.30.

Admission: £4.50 (inc. VAT). Lunch will be available at £4.00 (inc. VAT) per head if there is sufficient demand.

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NO 1 november 1978

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INTRODUCTION

The first issue of any magazine is an exciting time — certainly for the people working on the project and, hopefully, for the readers. Computing Today, although presented free with ETI, is just such a new magazine, which will have a style and identity of its own.

Computing Today will cover the fields of computing, from the home, education, and small business viewpoints. Computing to us will mean everything from the complete small business system, floppies and all, to a single bit micro in a control application.

The growth of small systems over the past few years has been astounding the reasons for this growth are many and varied — we won't go into them here — and it is our hope that the next few years will see this expansion maintained.

One of the reasons for launching Computing Today was the fact that it was no longer possible to devote enough space within ETI to cover this important area of small systems without sacrificing other features of ETI that are equally important to many of our readers. ETI plus CT will allow us to keep everybody happy.

Although this first issue of CT is only 32 pages, if the growth we mentioned is maintained, rest assured that CT will grow to keep pace.

This first issue of CT is published to coincide with the launch of the TRITON, an exciting new system for the hobbyist/education areas. CT has similar, equally exciting projects in the pipeline and if you don't want to miss out on important news and developments in Computing be sure to read us every month.

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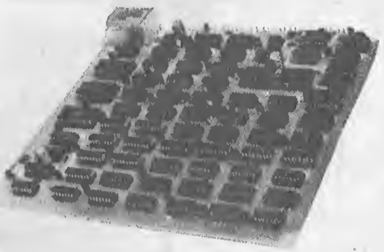

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(See page 16, ETI, Oct. '78 for feature details)

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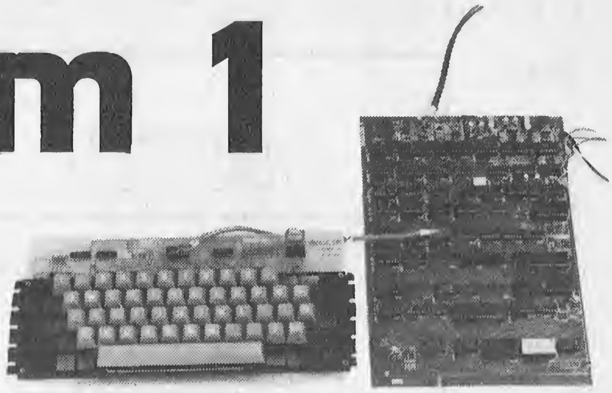
We take a look at one of the most advanced CPUs evaluation kits

The Nascom 1 Reviewed



THE NASCOM 1 Microcomputer kit was launched by Lynx Electronics at the Wembley Conference in November 1977. At that time, a sales figure of 500 kits was anticipated but it has been so popular that orders in excess of 10 000 kits have now been received. A look at the main features of Nascom 1 will explain this success.

For £197.50, you get:

- A Z-80 CPU,
- an uncommitted PIO,
- 2K of static RAM,
- a powerful 1K monitor (in a 2708 EPROM),
- a TV modulator,
- a full keyboard (assembled),
- cassette or RS 232 interface (but not both at the same time),
- an IM6402 UART,
- a double-sided PCB with plated-through holes,
- all other active and passive components, wire, solder and complete documentation.

The system is easily expandable through a 43-way edge connector but there is no on-board buffering (due to cost) although Nascom's plans for future expansion include a buffer board. In order to have a working microcomputer, only a power supply and a domestic TV need be supplied, plus an ordinary portable cassette machine for program storage.

Construction

Constructing the kit is an easy task for the experienced constructor and even the first-timer should have no difficulty, providing the detailed and comprehensive instructions are followed carefully. It is, if anything, a little tedious — there are over 50 ICs, sockets are provided for all of them.

The PCB is worth special mention for its superb quality — a really professional job. All component and wiring positions are clearly marked on the board in a totally unambiguous fashion and since the instructions include a detailed section on component identification, there should be no location problems. The PCB has wire links to be made, each selecting a possible user option. Two deal with I/O port and memory selection, three with the UART and one with the on-board crystal clock. The instructions show standard connections for these links and explain the variations. They could also be replaced by miniature toggle switches to allow experimentation.

The keyboard is supplied pre-assembled and needs only the addition of the RESET switch to complete it. Again due to cost considerations, it is not ASCII coded, but is scanned by hardware under software control. Early keyboards had no engraving on the key tops for shifted characters but this has been corrected in a new version, which also has a more positive key action. However, both suffer from the amazing lack of a left-hand shift key!

Another minor criticism is the method of connection between the PCB and the keyboard. A multicore cable with a 16 pin DIL header plug is used at each end, which means that any strain on the cable is taken by the soldered joints. A proper ribbon cable with crimped connections to header plugs would be a much more satisfactory solution.

Power supply

The power supply requirements are:

+12V @ 150mA,
+5V @ 2A,
—5V @ 90mA
and —12V @ 12mA (for RS232 only).

Lynx supply a PSU kit as an extra but it does rather let down an otherwise excellent product. The kindest thing I could say about the design is that it is unusual. It allows for further PSU kits to be 'parallelled off' for expansion. Early PCBs also has the + and - rail markings reversed — one of the IC regulators' connections are incorrect, although the outline is right. There is no provision for diodes to protect against

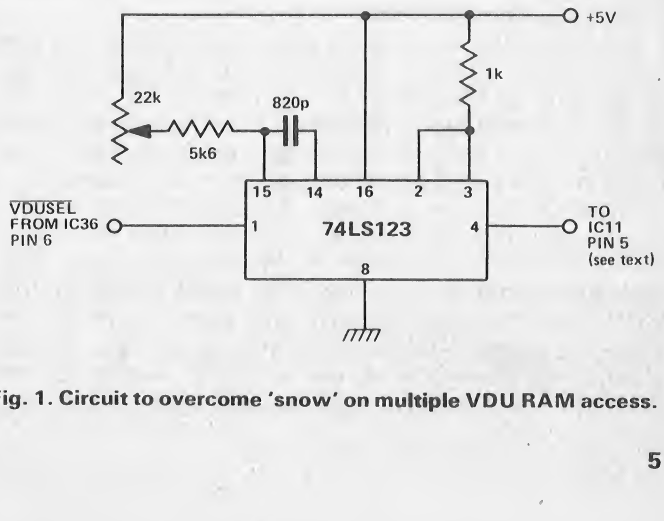


Fig. 1. Circuit to overcome 'snow' on multiple VDU RAM access.

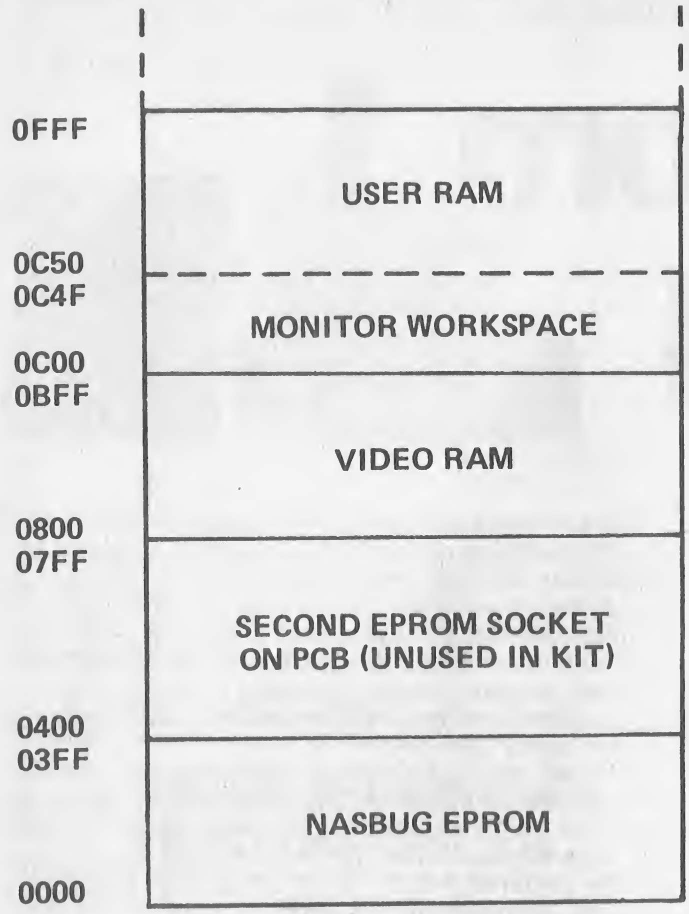


Fig. 2. System memory

voltage crossover (although diodes are supplied in the kit).

Now for the good news — the PSU is being completely re-designed and the parallel expansion approach dropped. Instead there will be an 8 amp kit for larger systems.

Memory and VDU

Before moving on to the operation of the kit, there are a couple of other hardware points to be mentioned. Firstly, the arrangement for resetting the CPU (by means of the RESET switch) would have to be altered for use with dynamic RAM expansion. CPU operation is suspended for as long as the RESET button is held down, so dynamic RAMs (assuming they are refreshed by the Z-80) would soon forget what they were doing. The buffer board will contain circuitry to correct this.

Secondly, the modulator seems to produce a very noisy signal. Picture quality is, to a large extent, dependant on the ability of a domestic TV to reject noise. Fortunately, commercial modulators are very cheap to buy and easy to fit to the NASCOM 1, as there is a 1V video signal output from the board.

NASCOM 1 uses a memory-mapped VDU, which means that the video RAM is shared with the CPU, the latter having priority. The instructions say that the video is blanked during VDU RAM access by the CPU but this is only partially true. In fact, the blanking signal (VDUSEL) is not long enough, so that a noise signal which shows as 'snow', especially on multiple VDU RAM access, appears on the screen. This can be simply corrected by using the circuit in Fig. 1 Pin 5 of IC 11 should be bent out from the socket and the connection made with an insulated 'sodercon' socket. Increase the potentiometer value until the snow just disappears.

Display Format

The format of the display is 48 characters wide by 16 lines deep, which produces a very readable picture on a domestic TV. The remaining 256 bytes (1024 — (48 x 16) = 256) of the 1K video RAM block are in the margin of the display, since the video RAM address counter is not disabled during the undisplayed portions of the video signal. In addition, the bottom 15 lines of the display (plus margins) are scrolled by the monitor, making the unused RAM locations useless.

The fact that only 15 lines are scrolled leaves the top line for header text or data. This is a very useful feature, since almost all programs can make use of a fixed display line. Figure 4 gives details of the VDU addressing and scrolling.

Operating System

The operating system is held in a 2708 (1K x 8) EPROM, which goes by the name of NASBUG. Since July, kits have been supplied containing NASBUG MK2 as the original version contained an error in the serial input routine and a couple of errors in the keyboard look-up table. However, these facts should not detract from the excellent software which is crammed into the 1K of NASBUG.

To call a command, only a single letter need be entered, followed by a number of arguments in HEX. Leading zeroes may always be omitted on input.
The commands are as follows:

modify: M aaaa
The monitor responds by printing address aaaa followed by the contents of that memory location, followed by a prompt and the cursor. If only examination of the memory location is required, pressing NEWLINE will step through the memory sequentially, printing information in the same format. The command is aborted by fullstop newline. Memory may be modified by entering new data after the prompt.

tabulate: T aaaabbbb
Prints on the screen the contents of memory between addresses aaaa and bbbb.

copy: C aaaa bbbb cccc
Copies a block of memory, length cccc, from address aaaa to bbbb. Care must be taken that either bbbb is greater than aaaa plus cccc or that bbbb is less than aaaa, otherwise the data block will be corrupted.

execute: E aaaa
Executes a program starting at address aaaa. There are two occasions when no argument is required. Firstly, if a program is aborted by the RESET button, E NEWLINE will cause execution to start at the same place as the previous E command. Secondly, at a breakpoint, E with no argument will cause execution to resume from the breakpoint.

break: B aaaa
Will insert a special code at address aaaa in a user program. When this code is encountered during execution it will cause the program to stop, display

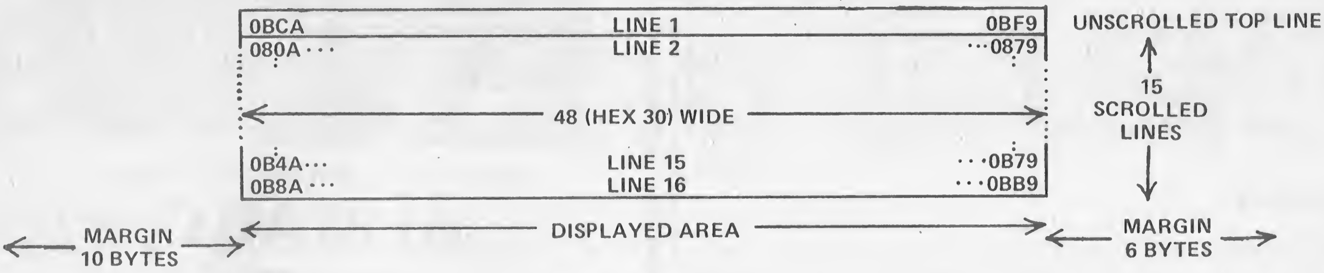


Fig. 4. VDU diagram

the registers and transfer control to the monitor. This means that any of the monitor commands may then be used. The BREAK command together with the STEP command provide very powerful debugging tools.

step: S aaaa
Will cause single step execution from address aaaa, with the registers displayed as in break at each step. Once single stepping is started, only NEWLINE need be pressed for the next stop and as with the execute command, the address will be assumed at a breakpoint.

dump: D aaaa bbbb
Dumps the contents of memory locations aaaa to bbbb to the serial output. Data is sent in blocks of 8 bytes, each with an address and checksum.

load: L
The opposite of dump. Loads data from the serial input (usually from cassette). The input format is the same as the dump output format (which is useful!).

Reflective Addressing

The monitor is made even more powerful by the use of 'reflective addressing' in the RAM. Some of the major routine addresses and data are found by the monitor by looking in certain RAM locations. The locations are set up at RESET but they can be changed manually (or during the course of a program).

The following data are found reflectively:
NMI routine address (used in single step and breakpoint exit),
command table address,
CRT address which controls cursor and scrolling,
keyboard scanning routine address,
address of the keyboard lookup table and its length and the stack pointer address for user programs (i.e. end of RAM).

The use of reflection and a scanning keyboard gives NASCOM 1 the advantage that the meaning of the

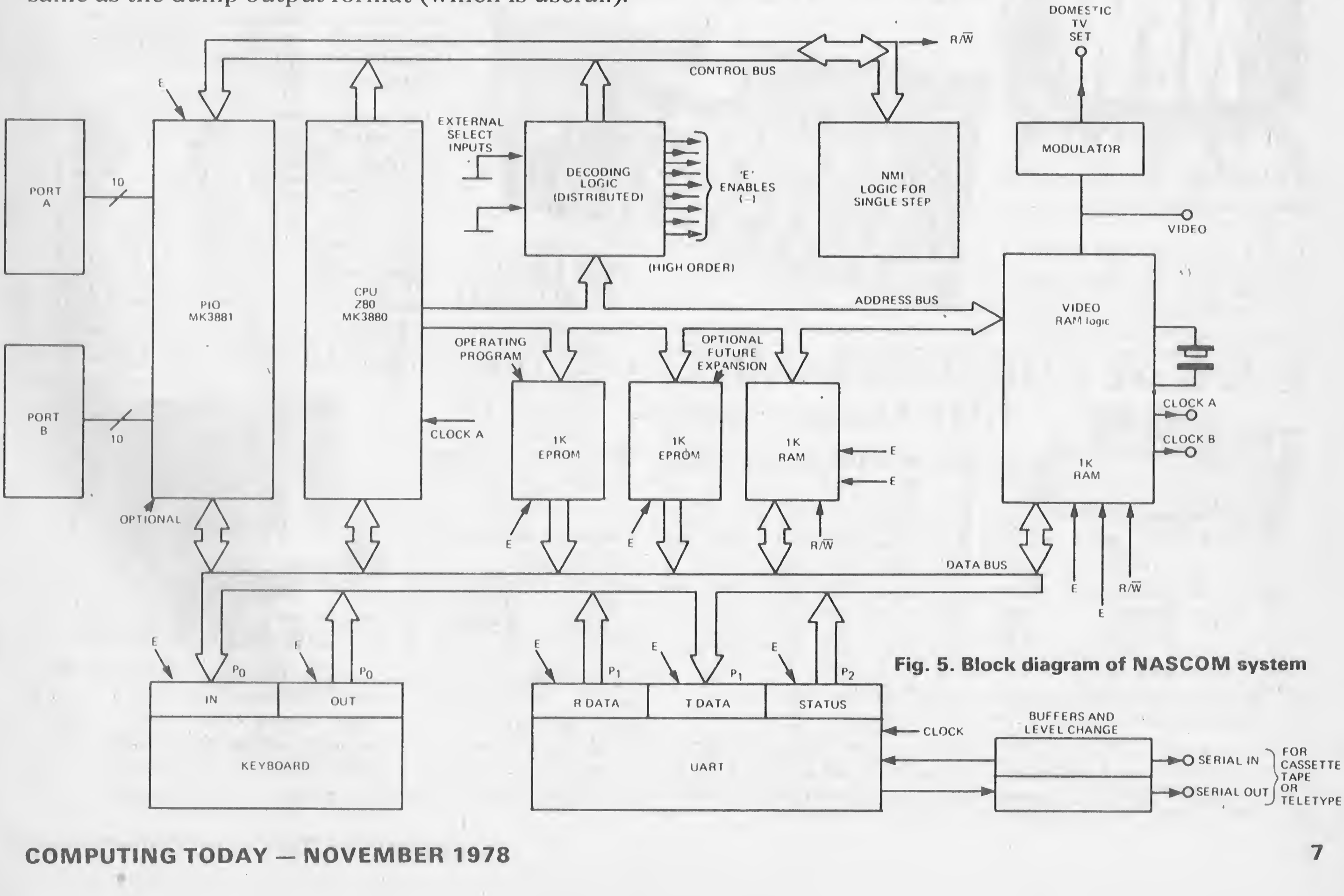


Fig. 5. Block diagram of NASCOM system

keys may be changed with ease and various combinations of simultaneous key pressing can easily be detected and acted upon. An example of the use of this feature is a program called SUPERSHIFT, by Richard Beal. The @ key is utilised as a sort of control key, enabling the complete character set of the MCM 6576 character generator to be used via the keyboard.

Summary

Overall, the NASCOM 1 is an excellent unit. It is easy to level criticism at any product, especially one which has been designed down to a price. rather than up to a specification, but I think that the compromise has been very successful in this case. There have been delays in the delivery, mainly caused by underestimation of demand, which in turn has caused delays in the development and despatch of the advertised add-on goodies (up to and including mini-floppy). Hurry up, Lynx.

To finish on a personal note, I've been using my NASCOM 1 for about 5 months (it worked first time) and I am very happy indeed with it. I can hardly wait for 16K and an assembler (MENTAL NOTE: Must send Christmas card to bank manager), although I am continually surprised at what *can* be squeezed into the 944 bytes available. The monitor is easy to use and fairly comprehensive, bearing in mind that it is only 1K. Debugging is a doddle with breakpoint and single step. NASCOM 1 is a real microcomputer at a relatively low cost and should be easily expandable to a really powerful system.

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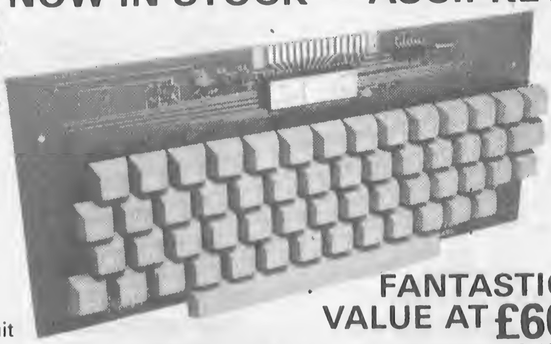

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This month we feature the first part of a software teaching series

Beginning BASIC

PART 1 Algorithms and flow charts

IT IS, UNFORTUNATELY, VERY EASY when watching a computer in action to subconsciously endow the machine with intelligence — under no circumstances is this the case.

Regardless of whether you are programming in the simplest of machine codes or the most sophisticated of high level languages, there is no way that the computer can do anything other than what it has been programmed to do, and the signs of intelligence that we seem to detect are present only because of the skill of the programmer. In fact, programming today is becoming quite a major business area, simply because of the amount of skill involved. As with every other trade, however, there are various tools which are at the disposal of the programer to help in in his work — one of the most important of these being the flow chart.

It does not matter what language we program in, be it machine code or BASIC, the technique of drawing and using flow charts is always the same.

We start with a problem, find an algorithm (finding an algorithm for a problem means finding a method of giving a complete and correct solution to the problem in a finite number of steps) to solve the problem, draw the flow chart and then write the program from the flow chart. In order that one programer can understand another's work, certain conventions are adopted when drawing flow charts (see Fig 1).

As a first example of algorithm and flow chart drawing, we will take the case of a young person applying for membership of a Social Club, wishing to discover what fees are payable as an annual subscription.

Consider the following —

"The annual subscription for a man is £10, unless he is under the age of 25, when the subscription shall be halved. The annual subscription for a woman shall be £8, unless she is under 25, when the subscription shall be halved. Married women applying for membership shall be charged half the amount payable by a single woman over 25."

In this instance, it is unnecessary to find an algorithm to solve the problem as we are only going to use the flow chart as a means of simplifying the wealth of information given above (see Fig 2).

So, for example, if you are a married female, it takes only a moment's glance at Fig 2 to answer the questions "Are you a man?" (no) and "are you married?" (yes) to arrive at the knowledge that your annual subscription shall be £4.

You can see from this example how the flow chart helps to clarify and simplify an otherwise apparently complicated problem.

We will now go on to consider the generation of an algorithm, and to see how a flow chart can be drawn once an algorithm has been obtained. As an example,

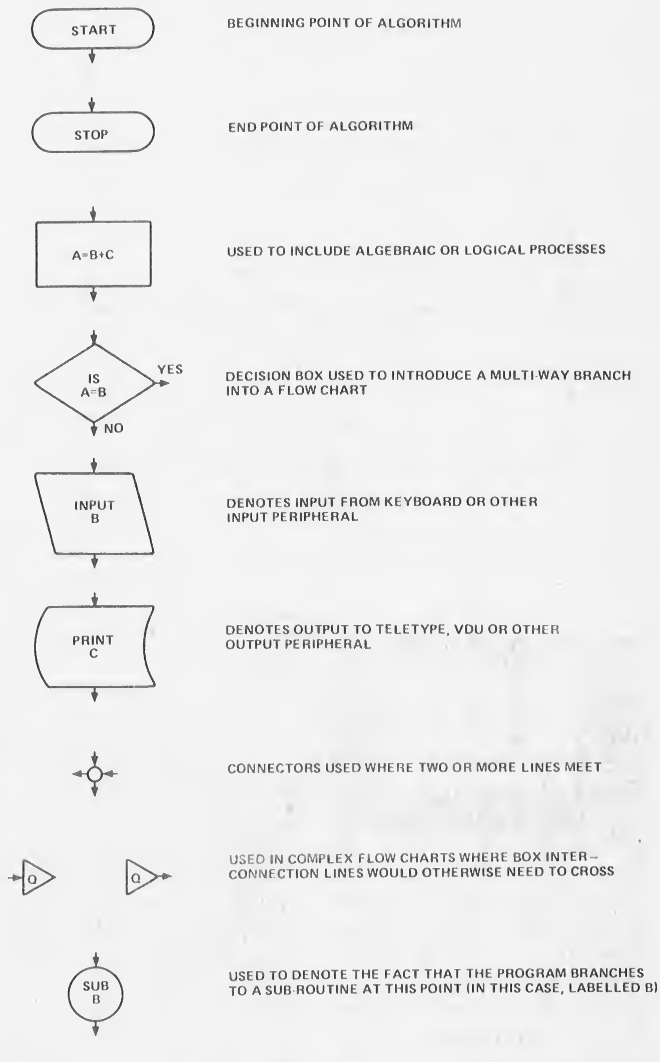

Fig. 1. Flowcharting symbols

we will look at how it might be possible to get a computer to generate a representation of, and randomly shuffle, a pack of cards.

The first thing we need to do is to decide what would be an acceptable representation of the pack. We could reasonably consider the problem solved if the computer could be made to generate a list of the numbers 1 to 52 in a random order, so that each number from 1 to 52 would represent a different card.

The first method that springs to mind is to get the computer to open a set of 52 storage locations. The first random number between 1 and 52 can then be generated and placed in storage location number 1 (the method used to generate the random numbers is

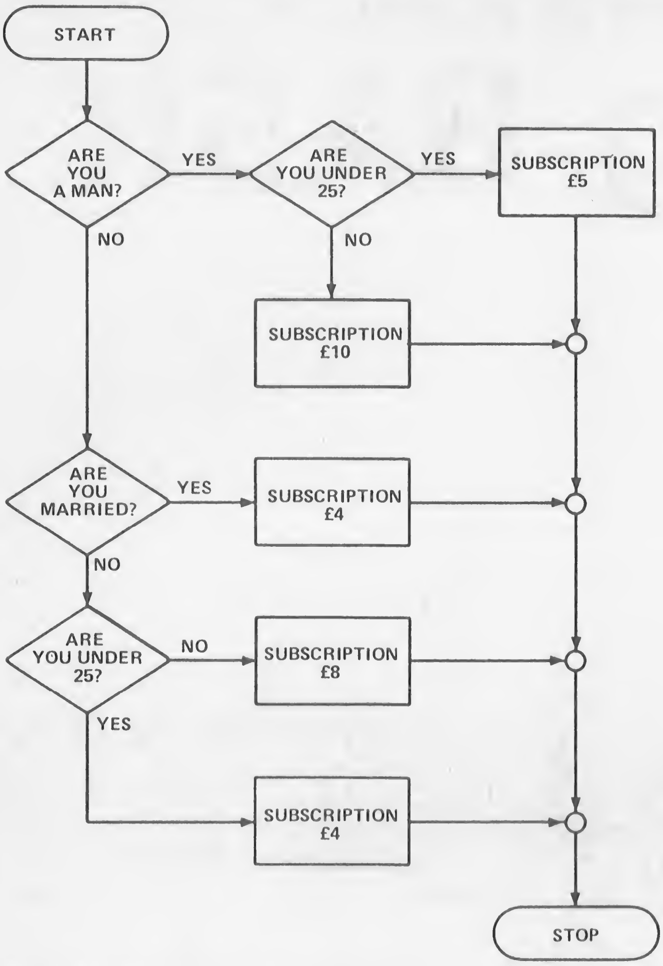

Fig. 2. Fee fie foe or fum?

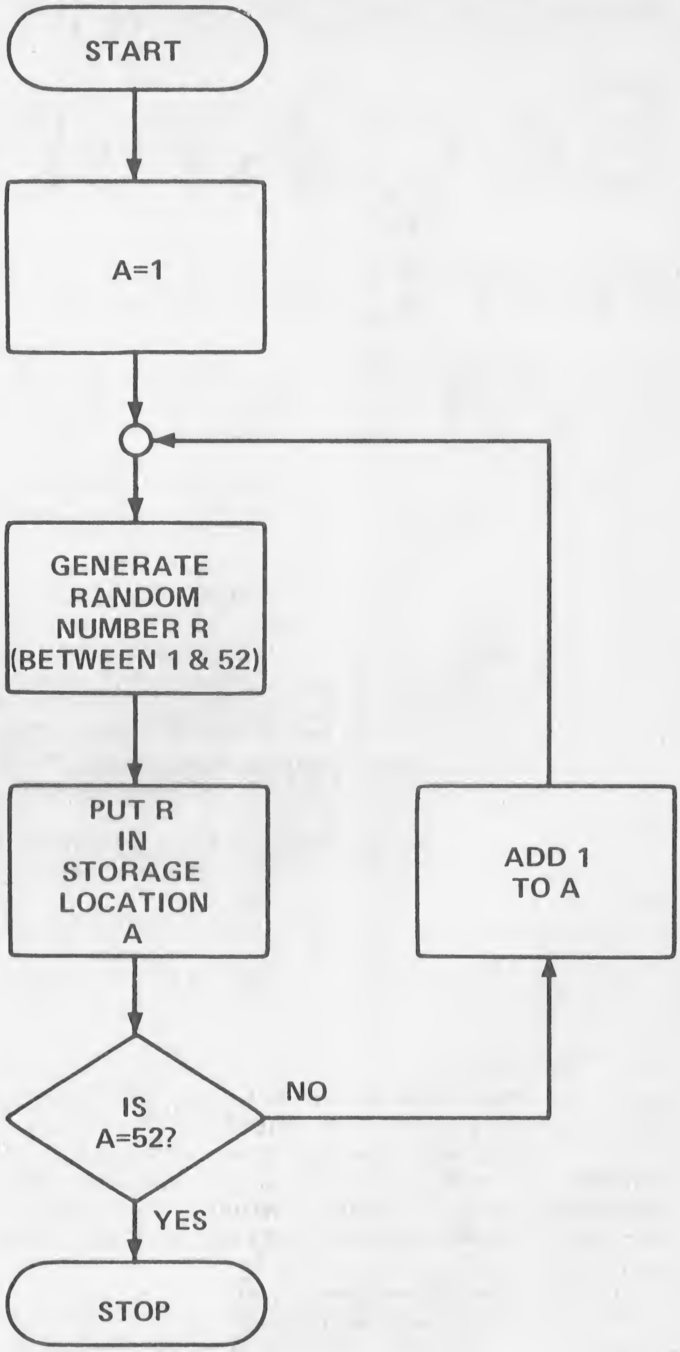

Fig. 3. Take a card, any card . . .

unimportant as far as the flow chart is concerned). A second random number is then generated and placed in storage location number 2, a third number in storage location 3, and so on until all 52 storage locations have been filled.

Fig 3 shows a flow chart to describe this algorithm. That appeared quite simple, didn't it? But if we give the problem some further consideration, you will see it is possible, since the numbers we are generating are random, to have generated two numbers which are the same. Indeed, this is most likely. This would mean that we would have at least two cards the same within one pack, and so our algorithm must be considered incomplete (though on the right track). To make the algorithm work correctly, we will have to include some form of check to ensure that when a number is generated which has already been used, it is not included in the list (see Fig 4 for a flow chart which takes this point into account). If you look through Fig 4, you will see that a number is generated and then a check is made through all the storage locations that have already been filled to see if the number we have just generated has occurred before. If it has, then the number is ignored and a new random number is generated and checked; if it has not, then it is inserted into the next empty storage location. We then jump back and generate another random number and the process continues until all 52 storage locations have been filled.

This algorithm and subsequent flow chart would appear to be quite sufficient to solve the problem. But let us now consider this flow chart converted into a program and being run on a computer. Remember, every operation the computer executes takes some finite time to perform, albeit small, so that the more operations that need to be performed, the longer the program will take to run. This may appear to have been an obvious statement, but let us take a look now at our algorithm, bearing this point in mind. When we start off, with all storage locations empty, the first number we generate can be guaranteed not to have occurred before (though looking at the flow chart you will see that the computer does not know this) and can therefore be inserted straight into the first storage location. As the program proceeds, however, and more storage locations filled, it becomes more and more likely that the generated random number will, after some considerable checking, have to be abandoned and re-generated, until, when there are

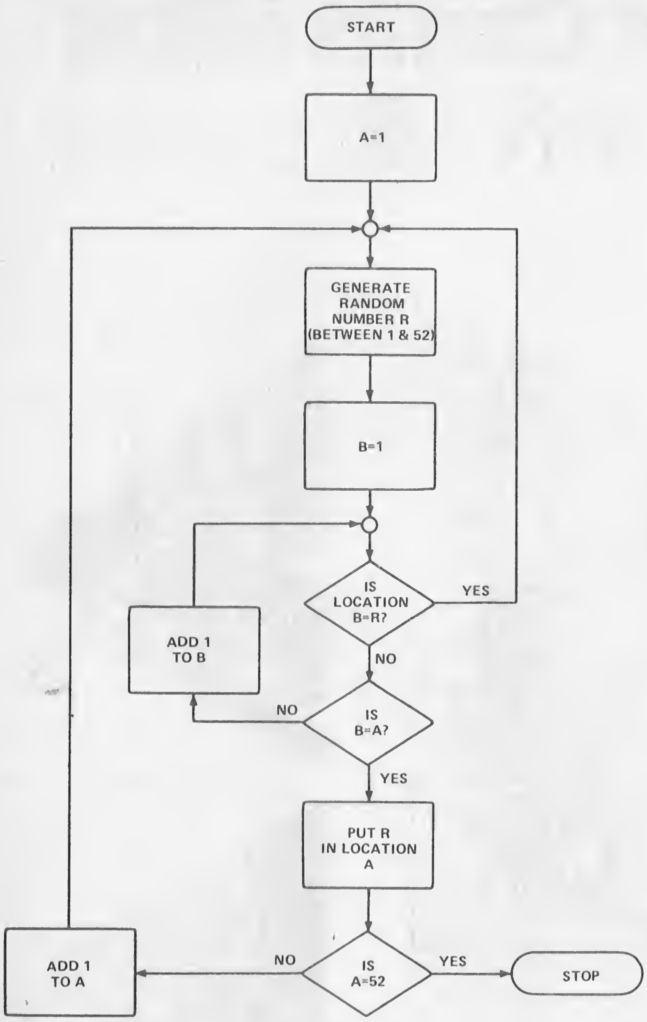

Fig. 4. The new routine.

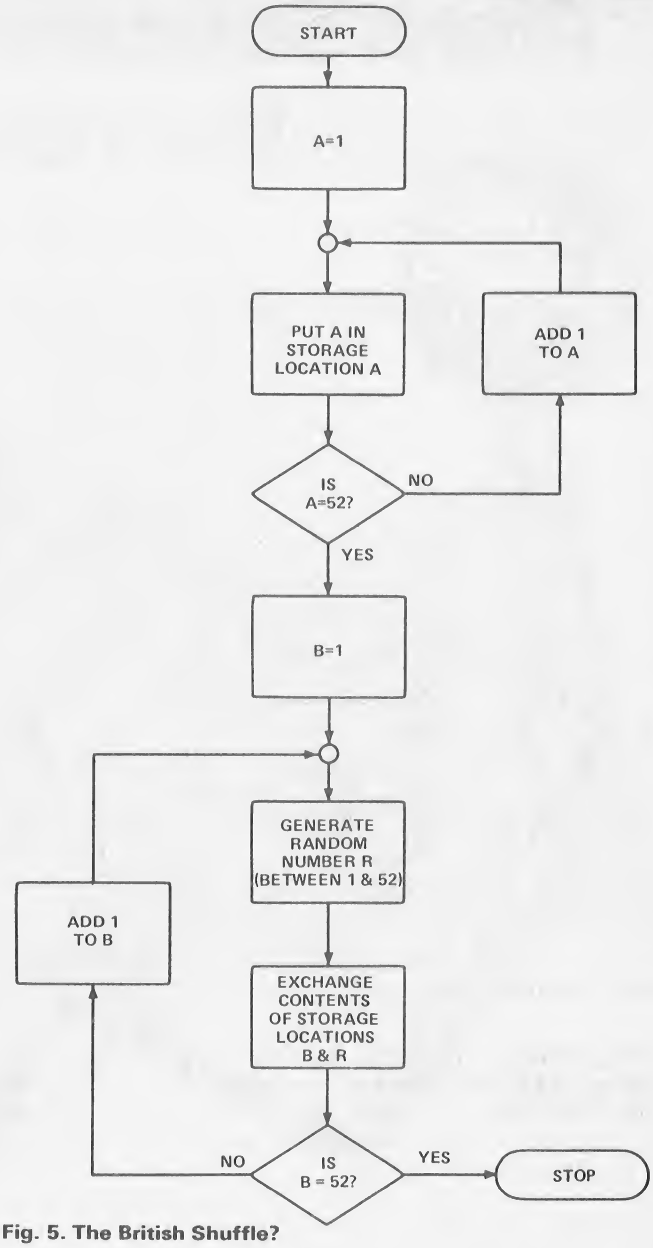

Fig. 5. The British Shuffle?

only two or three locations left to fill, we may have to generate and extensively check many tens of numbers to find one of the few remaining acceptable numbers. If the computer was made to print out each number as it was generated, we would notice a longer and longer time interval elapsing between the generation of consecutive numbers. Problems like this occur frequently when converting algorithms, where a solution which initially appeared to be satisfactory turns out to have some practical difficulties associated with it on closer inspection.

Fig 5 shows the flow chart of an algorithm designed to overcome the previous problem.

It starts by putting 1 in storage locations 1; 2 in location 2; 3 in location 3; and so on until all 52 locations are filled, which in effect lays the cards out in sequence through the pack. It then takes the first location and exchanges its contents with the contents of another randomly chosen location, then the contents of location 2 are exchanged with the contents of a second randomly chosen location; the contents of location 3 are then exchanged with the contents of a third randomly chosen location, and so on until the contents of all 52 storage locations have been randomly exchanged in this manner. You may be a little sceptical as to whether the pack of cards thus generated was truly random. Experiments have, however, convinced us that it is. As you can see, there is never any need to generate more than 52 random numbers, because whatever the number generated turns out to be, we are always guaranteed to use it, as it does not matter whether it has been generated before or not. Converting both of these flow charts into programs and running them on a computer, we discovered that this latter algorithm ran approximately ten times as fast, on average, as the first algorithm, so that there is a great saving in computer time used.

Looking through the algorithms and flow charts, you should begin to see that every operation a computer performs has to be very carefully planned and mapped out if a worthwhile program is to result. Although able to operate at extremely high speeds, the computer is merely manipulating pulses of electrical current according to a set of rules which the programmer lays down which, by careful manipulation and interpretation, can be made to have meaning.

Next month we will go on to consider the high-level programing language, BASIC, but do not forget the above routines, for when we have learnt sufficient BASIC, we will be returning to look at them again and see how they can be implemented **CTI**

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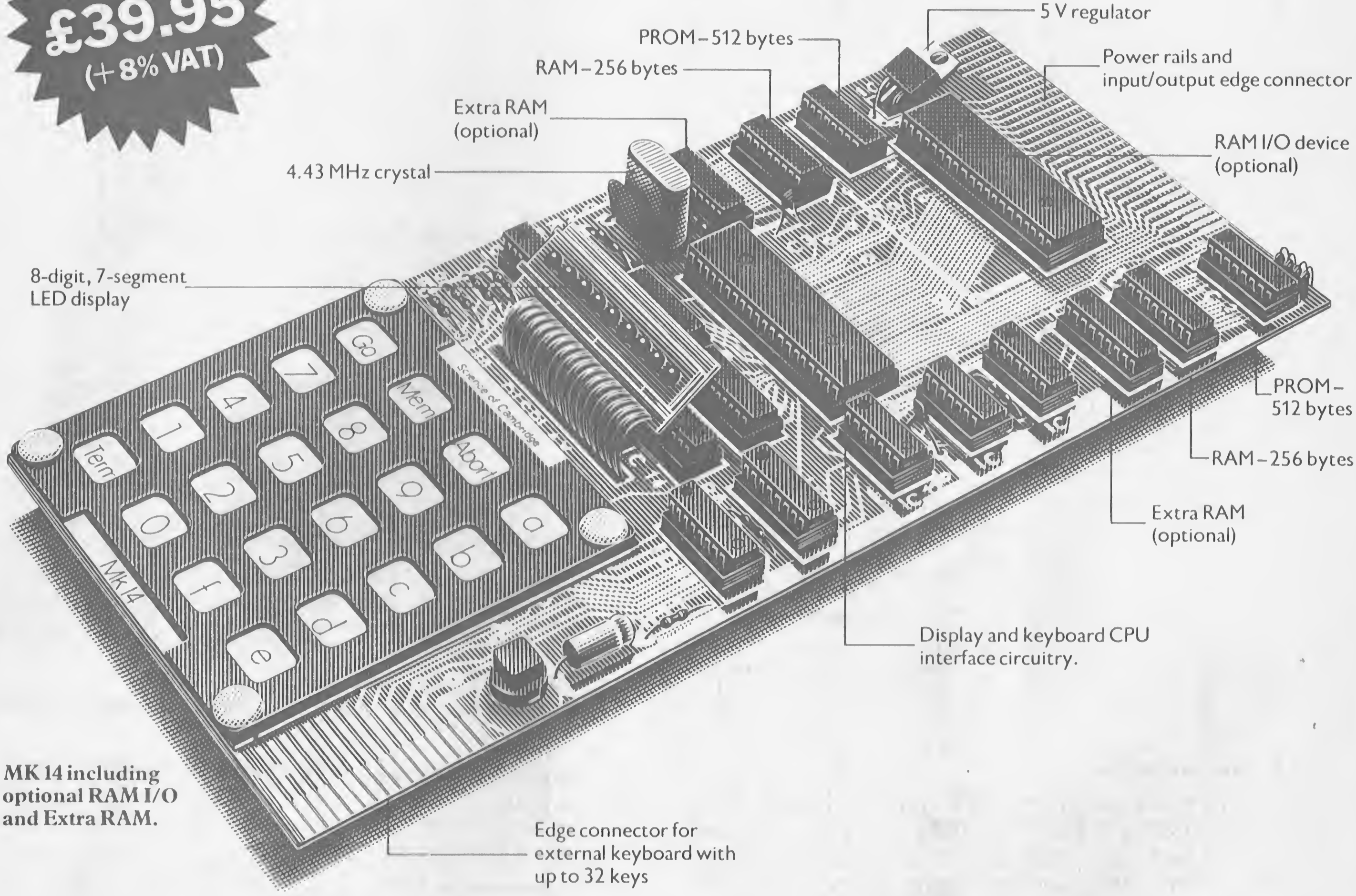

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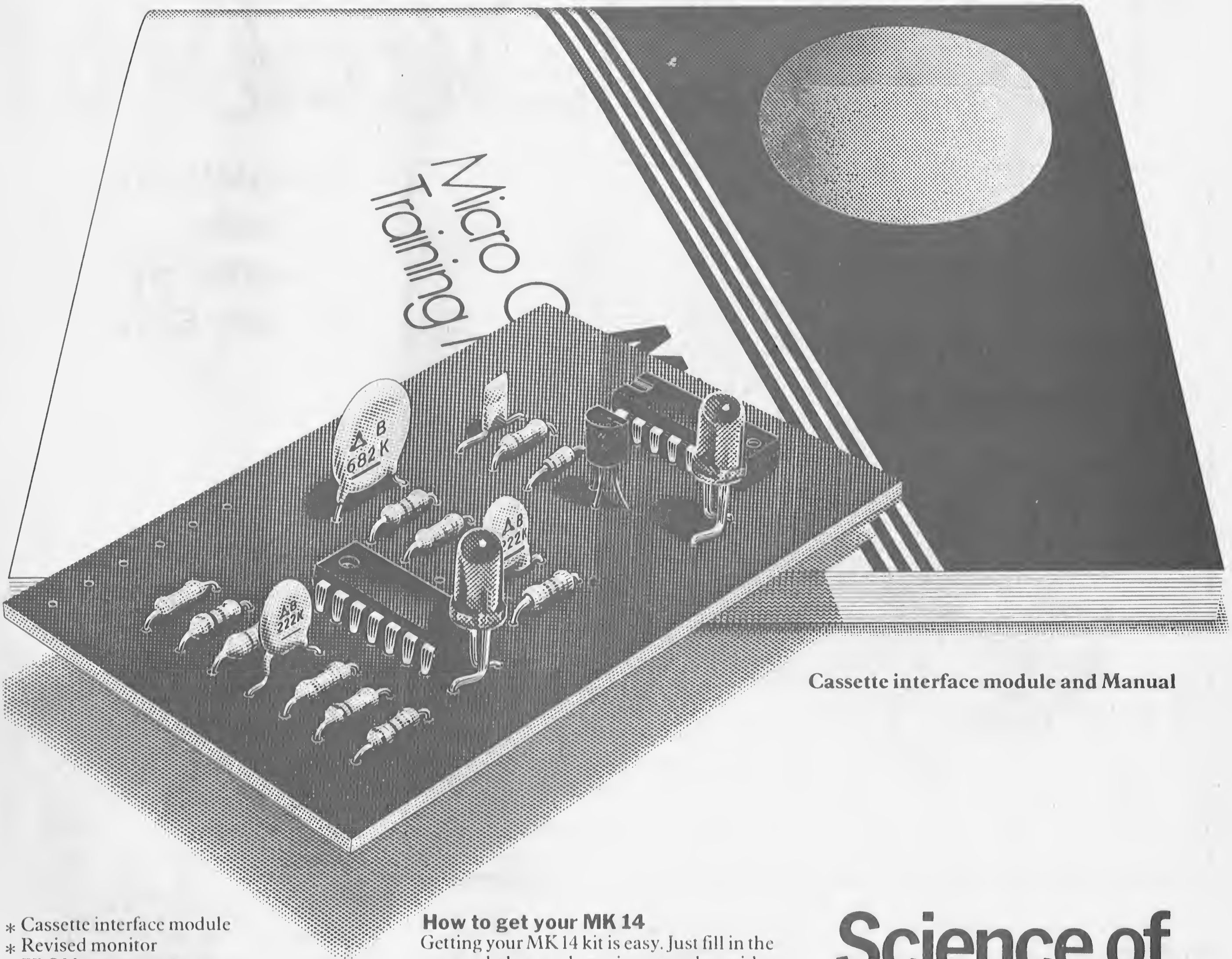

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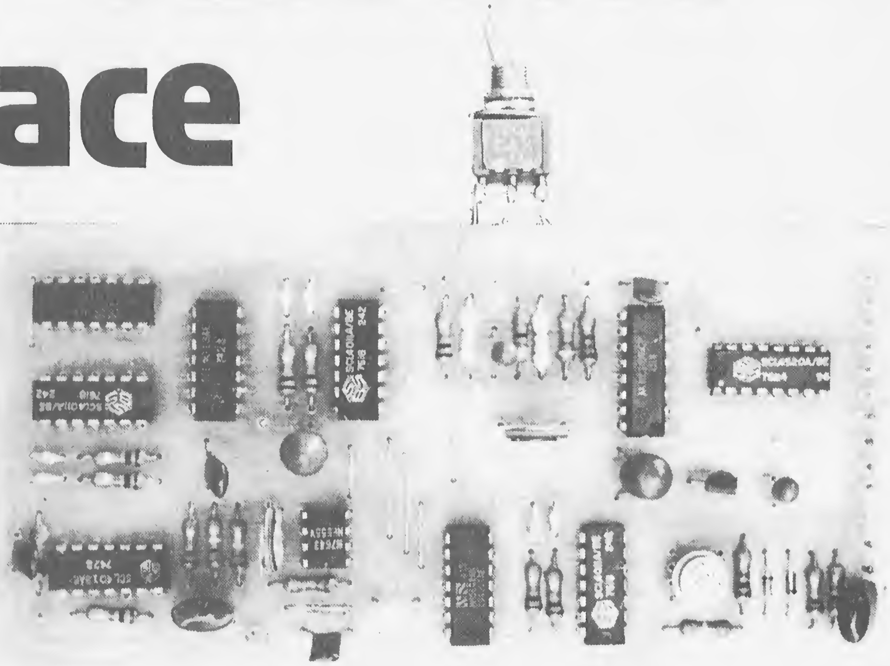
This unit allows you to program your microprocessor from a prerecorded cassette or to record your own program for later use. Design by Trevor Marshall.

CUTS Cassette Interface



REPEATEDLY TYPING IN programs is not what hobby computing is about. Although most systems start life without any form of off-line mass storage, as more memory is added so more programs are written and the need for some form of storage becomes more pressing. The ideal device for this job is probably the floppy disk, but this is (a) expensive and (b) usually dedicated to one processor or bus structure. Many hobbyists are running several small systems, and a device which is less convenient but more suited to their needs (and pockets) is the humble cassette recorder.

This interface is designed to convert the digital signals from your computer to audio tones and back again, using a standard system called CUTS (Computer Users' Tape System), which is also referred to as the Kansas City or Byte format. This records data at 300 baud, with a logic '1' recorded as eight cycles of 2400Hz and a '0' as four cycles of 1200Hz. A byte of data is recorded as a start bit of logic '0', followed by eight bits of data and two stop bits of logic '1', and this is taken care of by the UART in your computer.

Although the standard is 300 baud, the monitor programs in some kits allow only 110 baud operation, and this interface will work at 110 baud. It can also be run faster (up to 1200 baud) to allow faster program loading.

We have not described a case, as most constructors will wish to mount the board either on the back panel of their computer or in the VDU. Also switching between VDU and cassette will depend upon the user's computer — the ideal situation is to have two UARTs for both VDU and cassette, but many systems (or rather their monitors) do not permit this.

Construction

This is simply assembling the PC board. Take care when handling the ICs as most are CMOS. As the unit will probably be built into a system we have not given any mechanical assembly details. The record/play switch can be mounted remotely if desired.

Alignment

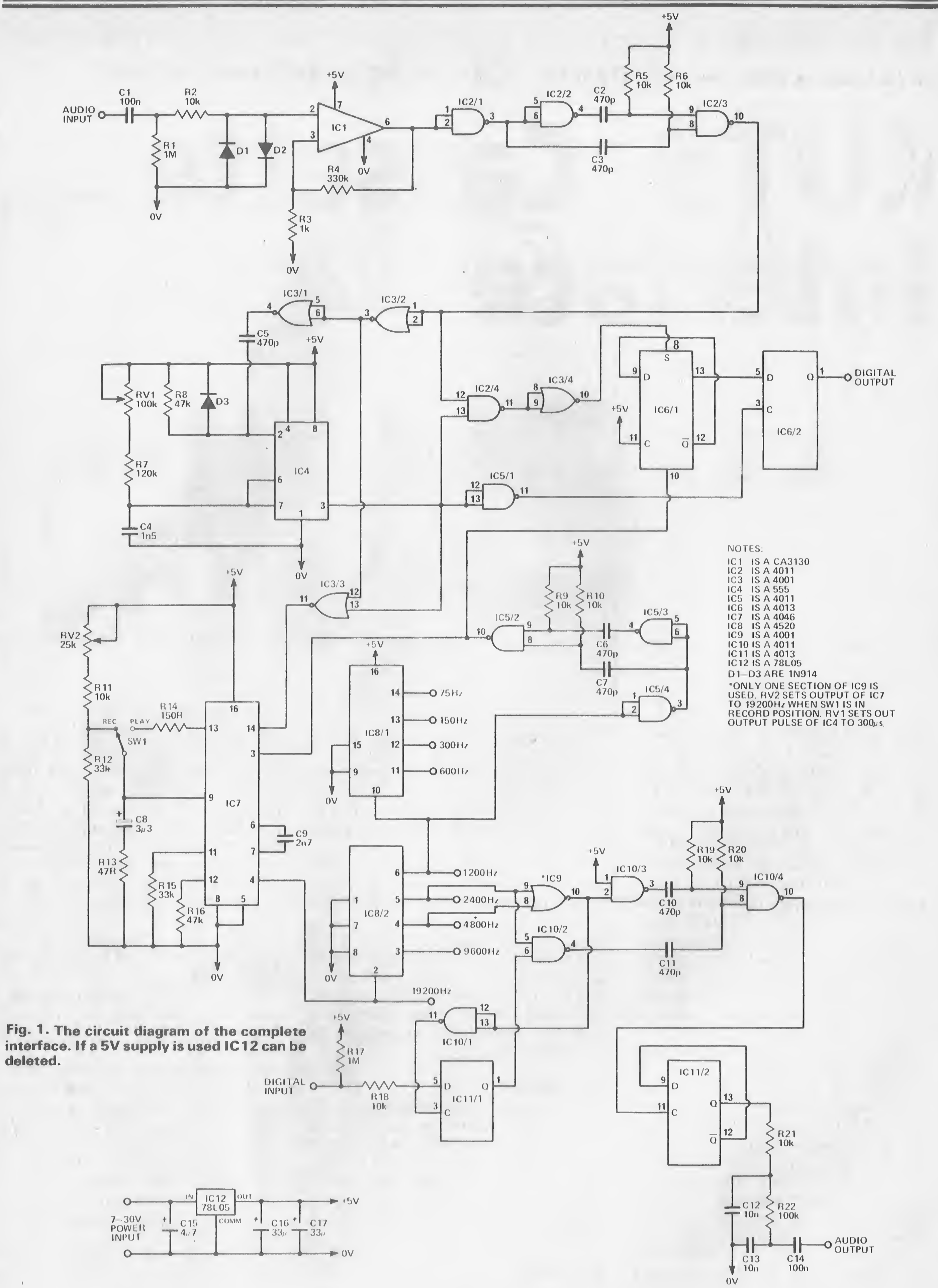
The only adjustments on the unit are the record frequency and the monostable period. Switch the unit to record and monitor the frequency at any of the baud rate outputs and adjust RV2 to give the correct frequency. Now inject a 1200 Hz tone into the audio input (take of from the baud rate outputs when in the record mode) and adjust RV1 to give a 300us wide pulse at pin 3 of IC4. If an oscilliscope is not available, setting RV1 to mid position should be close enough.

Recording

For best results recording should be done at a relatively low level. We found that about – 7VU gave the best results.

Unfortunately the use with a recorder with an automatic level control did not prove satisfactory. This is because the level control logic is designed for music where the peak level is about 10dB or more higher than the average. This cannot cope with a continuous tone without it being recorded at too high a level.

One method which has been suggested to us is to record a high level high frquency tone (about 18kHz) as well as the signal. Theory



NOTES:
IC1 IS A CA3130
IC2 IS A 4011
IC3 IS A 4001
IC4 IS A 555
IC5 IS A 4011
IC6 IS A 4013
IC7 IS A 4046
IC8 IS A 4520
IC9 IS A 4001
IC10 IS A 4011
IC11 IS A 4013
IC12 IS A 78L05
D1–D3 ARE 1N914
*ONLY ONE SECTION OF IC9 IS USED. RV2 SETS OUTPUT OF IC7 TO 19200Hz WHEN SW1 IS IN RECORD POSITION. RV1 SETS OUT OUTPUT PULSE OF IC4 TO 300μs.

Fig. 1. The circuit diagram of the complete interface. If a 5V supply is used IC12 can be deleted.

How It Works

This unit records digital information on tape in serial form using two tones, 2400 Hz for a "1" and 1200 Hz for the "0". The standard transmission rate is 300 baud but it will work equally well at 600 baud. The designer has operated his unit at 1200 baud with success but with only one cycle of 1200 Hz per bit it is more prone to dropout, etc.

Decoder

We will start the explanation of how it works by assuming you have a prerecorded tape. The output of the tape recorder (alternate tones of 1200 and 2400 Hz) is "squared up" by IC1 which is connected as a schmitt trigger with R3 and R4 providing the necessary positive feedback.

The gates IC2/1, IC2/2 and IC2/3 are used to generate a positive pulse about 3μs wide on both the leading and trailing edges of the output of IC1. This gives a series of pulses at either 2400 Hz or 4800 Hz (417μs or 208μs period).

The pulse chain triggers the monostable IC4 which is 300μs wide. If a second trigger pulse occurs before the 300μs period (as it will if the input is 4800 Hz) the second pulse is simply ignored. The input pulse chain is gated with the monostable output in IC3/3, the resultant output being pulses at 2400 Hz whether the input frequency is 2400 or 4800 Hz.

These pulses are used for the reference for the phase locked loop (PLL) IC7. This IC contains a phase detector and a voltage controlled oscillator. The output of the oscillator is divided by 2^8 in IC8. After dividing by 2^4 (16) IC5/2, IC5/3 and IC5/4 are used to generate 3μs wide pulses on both leading and trailing edges and this output is the second input to the phase detector in IC7. The output of the phase detector (pin 13) is used to control the oscillator (input is pin 9) and the two pulse chains are equalised in frequency and phase. Using this technique the tape speed can be varied by up to $\mp$20% and the PLL will track it. The outputs of IC8 can be used to control the UART in the computer. If the UARTs own clock is used the allowable tape speed variation is $\mp$5%.

To decode the pulse chain into "1" and "0" and to ensure correct phasing, IC2/4, IC3/4, IC5/1 and IC6 are used. The monostable IC4 is triggered at 2400 Hz, and its output clocks the D input of IC6/2 into the output. IC6/1 is used as an R-S flip flop being "set" if a pulse from IC2/3 occurs during the "mono" period (if the input is high frequency) it is reset every 417μs by IC5/2. However, the information is clocked into IC6/2 before the reset pulse occurs. If the input is only a 1200 Hz tone the set pulse does not occur and a "0" is strobed into IC6/2. An examination of the timing diagram in fig. 1 will help clarify the sequence.

Encoder

The encoder is a little more complex than needed for 300 baud, but it allows operation at 600 or 1200 baud if needed. The output of IC9, which is a non-symmetrical 2400 Hz, triggers a 3μs monostable IC10/4 which then toggles IC11/2 giving a 1200 Hz square wave output. However, if the "data input" is a "1", IC11/1 is toggled to give a "1" at pin 1 which enables IC10/2. This then triggers the monostable IC10/4 midway between the pulses due to IC9. This then toggles IC11/2 at twice the rate to give 2400 Hz output. The clocking of the data input into IC11/1 is about 100μs out of phase with the rest of the timing to give time for the UART to settle, eliminating any errors due to propagation delays.

The phase locked loop IC is used only as an oscillator in the transmit mode and the VCO input is switched to a preset voltage giving the correct frequency.

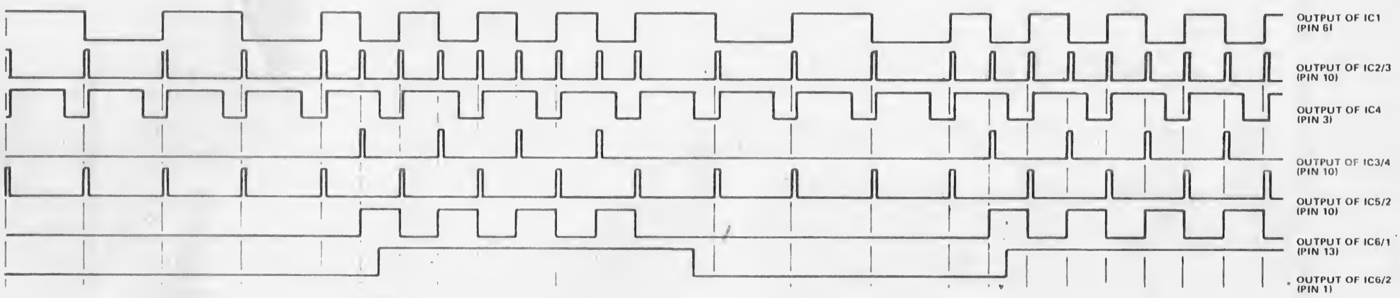


Fig. 2. The sequence of events in the decoder when receiving a '0,1,0,1' input.

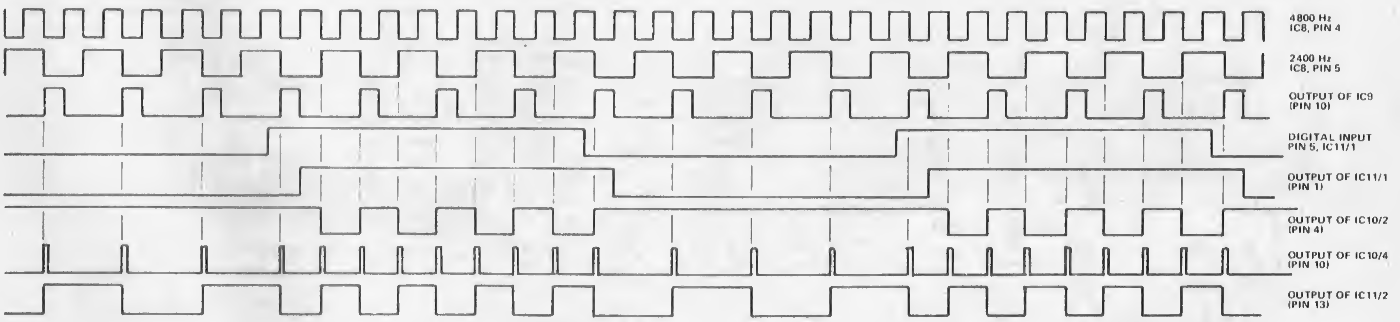


Fig. 3. The encoder waveforms when transmitting a '0,1,0,1.'

is that this tone will adjust the automatic level control while being too high to be reproduced. However it can beat with the bias oscillator causing more problems than it solves.

We therefore recommend that the unit be used only with a recorder with a manual recording control.

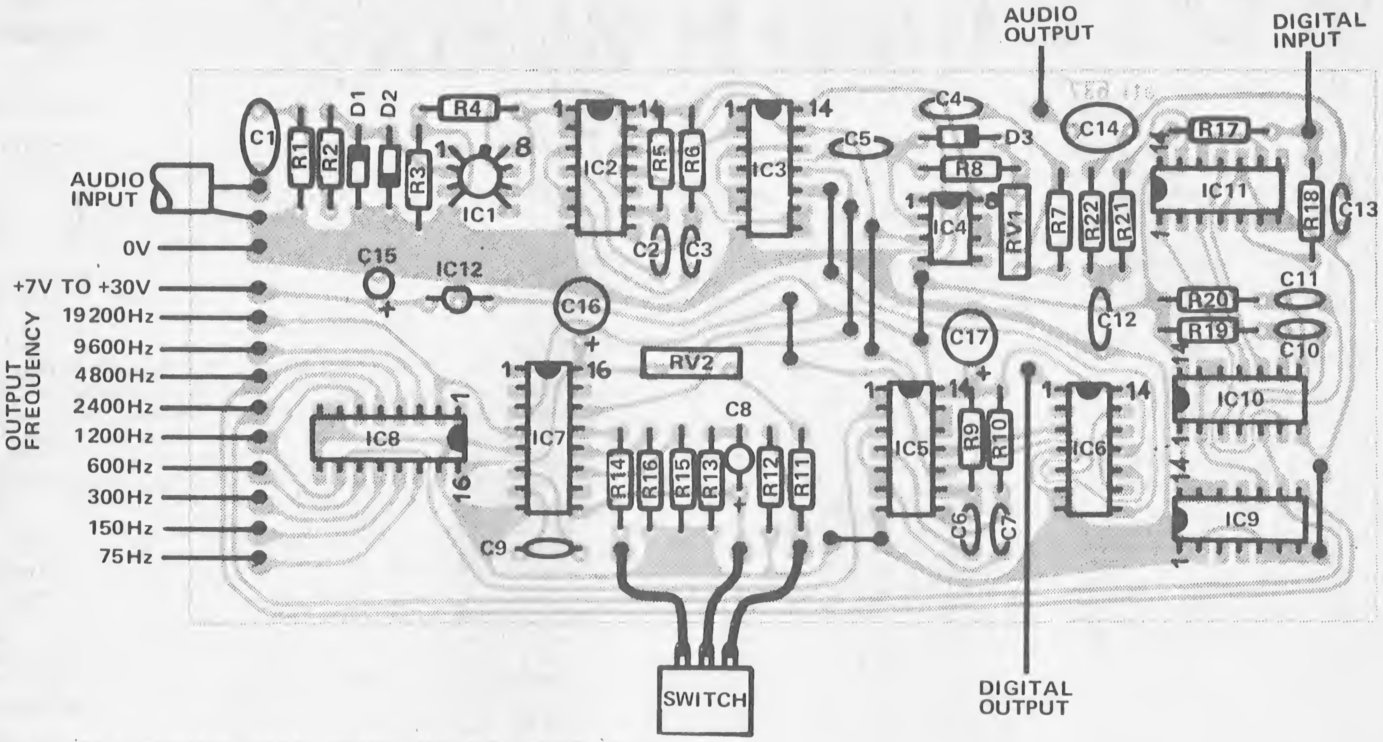


Fig. 4. The component overlay. When using a 5V supply leave out IC12 and add a link between the two outside holes. C15 can also be deleted.

Parts List

RESISTORS
(All ½w 5%)

R1	1M
R2	10k
R3	1k
R4	330k
R5,6	10k
R7	120k
R8	47k
R9-R11	10k
R12	33k
R13	47R
R14	150R
R15	33k
R16	47k
R17	1M
R18-R21	10k
R22	100k

POTENTIOMETERS

RV1	100k trim
RV2	25k trim

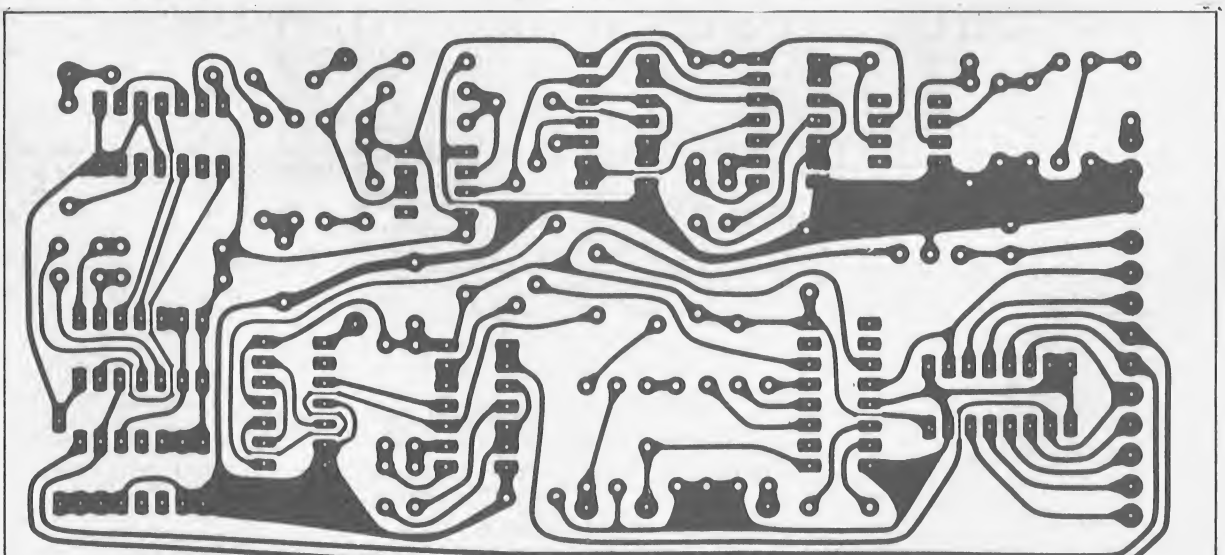
CAPACITORS

C1,14	100n polyester
C2,3,5,6,7,10,11	470p ceramic
C4	1n5 polyester
C8	3u8 25V electrolytic
C9	2n7 polystyrene
C12,13	10n polyester
C15	4u7 35V electrolytic
C16,17	33u 10V tantalum

SEMICONDUCTORS

IC1	CA3130
IC2	4011
IC3	4001
IC4	555
IC5	4011
IC6	4013
IC7	4046
IC8	4520
IC9	4001
IC10	4011
IC11	4013
IC12	78L05
D1-D3	1N914

MISCELLANEOUS
PCB as pattern
SW1 SPDT toggle



TRITON

John Coll, PCW consultant and well known to the computer hobbyist gives his impressions of the TRITON

I've had an early production model of the Triton for some time and I've been most impressed with it and with ETI's approach to the project.

On the hardware side it's clear that the designer Mike Hughes is a professional. The PCB is cleanly designed and good provision has been made for expansion at a future date. The addition of extra memory and of peripherals like printers and floppy disks will be a straight forward process. Whilst economy has been very much borne in mind. There has been no skimping, everything you need is provided to make a simple useful computer using a normal TV set as a display. The fact that where tracks have to go near IC pins, the tracks have been put on the upper side of the board — away from the constructors soldering iron — is typical of the attention to detail which is evident throughout the design.

On the software front the 2K basic interpreter is Li Chen Wang's Palo Alto tiny BASIC which has been around for some time and is therefore pretty much bug free, ie it works.

The monitor on the other hand is very much a version one — it works but could be improved considerably. However, this does not worry me in the slightest because all the software is in EPROM and therefore can be easily and cheaply altered. It is difficult to explain just how important that is — it means that users will be able to return the monitors to Transam and get them reprogrammed with the latest software for a very reasonable sum. It also means that if you want to use the computer for something else you can remove the BASIC and use the whole 4K of EPROM for your special application. This makes the machine potentially important in the process control field.

The documentation is good, however it seems only fair to say that the TOTAL novice would probably find it difficult to diagnose and repair any obscure fault. However, Transam's 'Get it going' service should deal with that in a satisfactory way. The availability of full source listings for both the monitor and BASIC will be useful in specialists applications as well as for the enthusiastic beginner.

It is clear that ETI are determined to 'Get this one right' and to support it in the future with further software and hardware.

I have no hesitation in recommending this kit to you.

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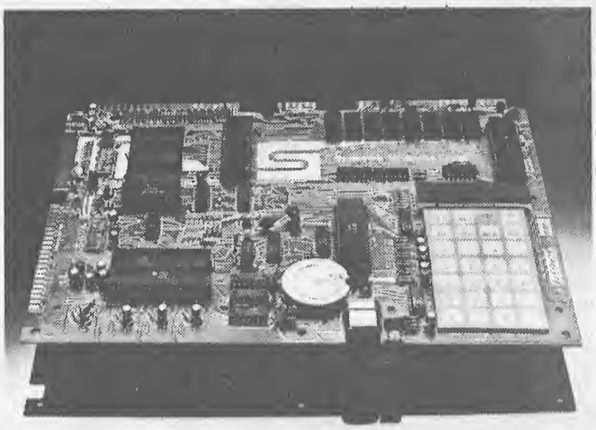

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East Coast Report

Proclaimed as the largest show ever, Personal Computing '78 was held in the Philadelphia Civic Centre, from the 24th to 27th of August. Computing Today roving reporter Jim Perry was there with his box brownie.

With more than 300 stands and over 100 exhibitors the PC '78 show certainly was large by any standards! To celebrate its third birthday the show had moved to the Philadelphia Civic Centre from its birthplace in Atlantic City. The move of venue was brought about by the tremendous growth in attendance — Atlantic City was just too small for this year's show!

The promoters of the event claim that just over 20 per cent of the American Personal Computer Market is within 2 hours drive of Phildelphia, this is probably because New York is just 2 hours away.

Amongst the many exhibitors there were surprisingly few new products — well, new to the American market at least — most of the products would be new in the UK if available here. With companies such as Heathkit, Radio Shack (Tandy) and Southwest Technical Products in attendance, it was Commodore that was conspicious — by its absence.

To complement the exhibition the organisers had arranged more than 80 hours of seminars, on everything from business systems to computer games. A good point was that all the daytime events were included in the exhibition admission fee. Other activities included a show of computer generated art, a computer music evening and traditional Saturday night banquet (read booze up). ▶

General view of the main exhibition area, early on the first day.

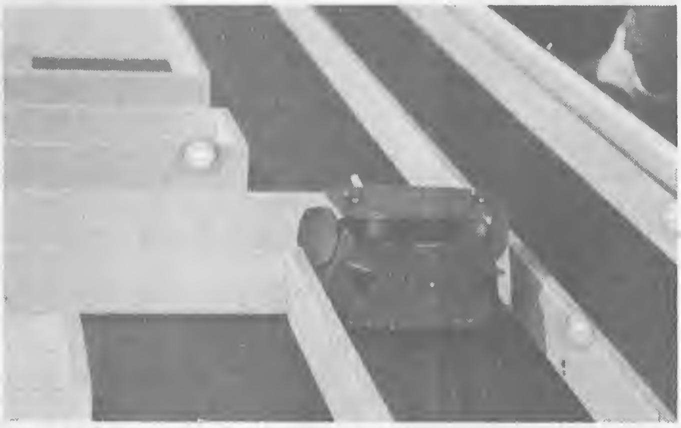
Not quite what you expect at a Personal Computer Show, but a lot of people were looking for complete systems for small businesses.

Software for the TRS 80 was available from many suppliers. This stand is demonstrating a chess recorder program.

The RCA stand was dedicated to their COSMAC VIP, the two small boards plugged into the back are the new music synthesiser and drum machine attachments.

Computer music was the theme on the SOL stand. The interface, between man, machine and music is one of the exciting growth areas.

The Bit Pad is a rather nice (but expensive) device for turning freehand into computer input.



Is it a bird? Is it a plane? No, it's a Micro Mouse! The second trials for the IEEE/Spectrum Micro Mouse Maze competition were held during the exhibition — this MPUed mouse made it through the maze in 4 minutes 45 seconds.

Computalker Consultants did a roaring trade with their versatile speech synthesis units.

The message centre used SWTP equipment to keep everybody up to date via several monitors.

The Radio Shack (Tandy) area was equipped with 12 TRS 80 systems, the complete range of peripherals (printers, floppies etc) was also on continuous demonstration.

Part of the British contingent, Chris Carey and Jim Wood from Comp Computer Components were scouting for new products to unleash on the UK market.

Exidy were demonstrating the Z80 based Sorcerer Computer — a nice feature of this machine is the plug in BASIC, which can be replaced with various other languages virtually instantly.

The TRITON software has some interesting facilities — we take a look at the whole package.

TRITON Software —BASIC

The TRITON BASIC Interpreter was designed to run on small 8080/Z80 micro processor systems. It contains many of the common BASIC commands and most small BASIC programmes will be easily converted to run on the Triton.

Variables

All variables and numbers are stored as 16 bit integers and therefore must lie in the range —32767 to 32767. There are 26 variables each denoted by a single letter A to Z. There is 1 array denoted by @, this array is automatically dimensioned to make use of any memory space left unused by your BASIC Programme. The number of bytes of memory space in this array can be obtained at RUN time using the SIZE function.

Functions

There are three functions available.

ABS(X)	which gives the absolute value of the variable X.
RND(Y)	which gives a random number between 1 and Y inclusive.
SIZE	which gives the number of bytes left unused by your programme. Hence the maximum index for the array @ ( ) is SIZE/2.

Arithmetic Operators

+ Add
— Subract
* Multipy
/ Divide

+, —, * and / operations must result in a value in the range —32767 to 32767 and as they are also integer, any division is rounded down. E.G. 5/2 gives 2, 2/3 will give 0.

Compare Operators

> greater than
< less than
= equal to
not equal to
>= greater than or equal to
<= less than or equal to

The compare operators are usually used with the IF command but can also be used in expressions. The result of any comparison is 1 if true and 0 if not true (false).

Expressions

Expressions are formed from number, variables and functions.

E.G. 10 LET A = 10 — A is set to 10
20 LET B = A — B is set to contents of A ie 10

Arithmetic operators are used in expressions and are evaluated from left to right, except that * and / are always evaluated first.

Spaces between numbers, variables and functions are ignored. Spaces inbedded in command words are not allowed.

Parentheses can be used to change the order of evaluation.

Parentheses can be nested, the maximum depth being limited by the size of the stack.

Conditional operators are usually found with the IF command

10 IF A = 1 B = B + 1

In this statement when A is equal to 1 the expression B = B + 1 is executed and one is added to the contents of B.

Conditional expressions can be combined to form multiple conditions and can also be used in arithmetic expressions.

Statements

A BASIC statement consists of a statement number between 1 and 32767 followed by one or more commands. If a statement contains more than one command, each command is separated by semi colon ;. The statement is ended by a carriage return.

```
10 LET A = 10
20 LET B = A
30 LET C = A + B
```

This can be written

```
10 LET A = 10; LET B = A; LET C = A + B
```

It should be noted that the latter method will be harder to change or correct.

The commands GOTO, STOP and RETURN must be the last command in any statement.

Commands

The following commands are available in the TRITON BASIC L4.1

LET

LET is used to set a variable to the result of an expression.

10 LET A = 10	The variable A is set to 10
20 LET B = (A-1) *2	The variable B is set to the result of the expression (A-1)*2 i.e. 18
30 LET @(3) = B/3	The fourth element of the array @ is set to 6 (The first element is @(0))

The expression need not be an arithmetic expression.

10 LET C = A ≠ B	If A equals B, C will be set to zero If A is not equal to B, C will be set to one

The LET command can be used to set several variables

10 LET A = 1, B = 2, C = 3

each part being separated by a comma ,

We can therefore rewrite an earlier example.

10 LET A = 10, B = A, C = A + B

Rem

The REM (Remark) Command allows the programmer to comment his programme. The interpreter will ignore the rest of the line.

100 REM THIS IS THE START OF THE SUBROUTINE Y = A*A + B

Print

The PRINT command is used to print numbers, variables, expressions, and text.

10 PRINT A — will print the contents of variable A

10 PRINT A*2 — prints twice the contents of variable A

10 PRINT 'THIS IS A TITLE' prints THIS IS A TITLE

Several variables, etc. can be printed at once. Each item to be printed is separated by a comma.

10 PRINT A,B,C — will print the contents of A followed by B and C on the same line.

Text can be used to qualify printout.

10 PRINT 'THE RESULT IS', A

Text can be contained by either single or double quotes, this allows the other type of quote to be printed.

10 PRINT 'ABC"CBA', "123'321" will print
ABC"CBA123'321

Numerical values are printed with leading spaces (Right Justified) in a field of width 8 characters. The field width can be altered using a # sign followed by the new width (i.e. # 3 gives a width of 3).

The field width will then remain effective until another # or the end of the current PRINT statement.

10 PRINT A, #3, B, #1, C — will print A in a width of 8 characters. B in a width of 3 and C in a width of 1.

#1 will result in C being printed Left Justified and any following printout will be shifted to the right if C is greater than 9

The field width can also be an expression

PRINT # I, A will print A in a field width equal to the contents of variable I

The maximum field width is 63.

Note that negative numbers require an extra character in the field width for the minus sign.

Extra spaces can be generated by repeated commas.

PRINT # 3,A,,,B will print a 3 character A, 2 spaces and a 3 character B

Several PRINT statements can be made to print on the same line by ending the statement with a comma.

Graphic characters can be printed using the PRINT statement. The description of the graphics font lists those Graphics which can be contained in quotes and will result in graphics being printed.

The PRINT statement can also be used to issue cursor control characters

10 PRINT ↑H — will issue a control H which will backspace the cursor

10 PRINT ↑I — will issue a control I which will forward space the cursor

10 PRINT ↑J — moves cursor down

10 PRINT ↑K — moves cursor up

10 PRINT ↑L — will clear the whole screen and reset the cursor. Note that this command must be followed by a delay before the next command (FOR I = 1 TO 250; NEXT I)

10 PRINT ↑M — will reset the cursor to the start of the line.

Input

The input command is used to read an expression

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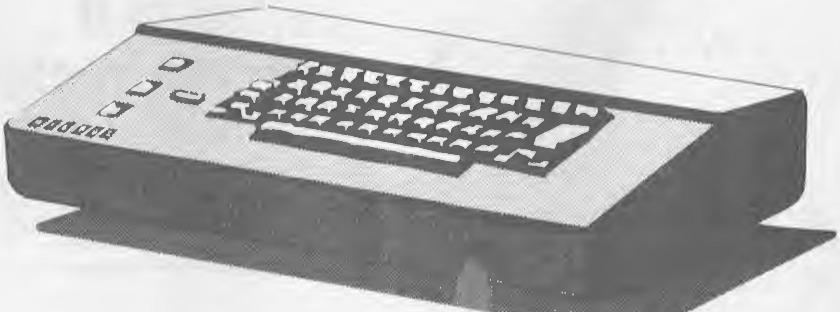

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from the Keyboard. Normally the keyboard input is just an integer value between —32767 and 32767.

10 INPUT A — When this statement is executed, the BASIC will first print A followed by a space and then wait for keyboard input. The input is terminated by carriage return. The input is then stored in variable A

10 INPUT A,B — will print A,space,then wait for input, it will then print B, space, and wait for input again.

Instead of just allowing the machine to prompt you with the variable, it is much better to ask a specific question. This is done by enclosing the text of the question in quotes.

10 INPUT 'HOW MANY EGGS HAVE YOU LEFT?' I

The machine will print HOW MANY EGGS HAVE YOU LEFT? and then wait of a number to be typed in.

If during RUN time, the typed input is not a valid expression, the prompt will be repeated and then the machine will wait again.

It is also possible to reprint only part of the prompt.

10 INPUT 'WHAT IS ', 'A+B?'C, 'A-B?'D

The first time the printout will be WHAT IS A+B? and after an invalid input it will just print A+B?

The BASIC interpreter uses its expression evaluation routine to decode the input and therefore the programmer or user can enter an expression using variables already set up.

10 LET A=3, B=2
20 INPUT C
30 PRINT C

Instead of entering a value for C, the user can enter an expression such as A+B, the expression will then be evaluated by the interpreter and the result 5 stored in the variable C. The machine will then print 5.

It is also possible to enter single characters as a reply by making use of the expression input.

10 LET Y=O, N=1
20 INPUT 'DO YOU WANT TO CONTINUE? Y OR N' A
30 IF A=1 STOP

If the user replies Y, A will be set to the contents of Y i.e. zero. If the user replies N-A will be set to 1 and the programme will STOP.

If

The IF command is used to compare expressions, using the compare operators. If the result of this comparison is true (non zero) the rest of the statement is executed. If the result of the comparison is false (zero), the rest of the statement is skipped and execution resumes on the next statement.

10 IF A=O PRINT 'A IS ZERO'

The machine will print A IS ZERO only when A is zero.

Note that unlike other BASIC interpreters and compilers, the word THEN is not used.

Either side of the compare can be an expression.

10 IF A=B*2 PRINT 'A IS TWICE B'
20 IF A*3=B*2 PRINT 'A=B*2/3'

A compare operator need not be used in the IF statement but this practice should be avoided where possible as it can make the programme very hard to follow.

10 IF A— 1 PRINT 'A IS NOT ONE'

»»

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the PRINT command is only skipped when the result of the expression in the IF command is zero.

Several commands can follow the IF command

10 IF A=0 PRINT 'A IS ZERO'; GOTO 50

When A is zero, the machine will print A IS ZERO and then jump statement 50.

GOTO

You will probably be fairly familiar with the GOTO command already as it has appeared in several of the examples for the other commands.

The GOTO command is used to break the sequential processing of the BASIC interpreter and cause the interpreter to jump either forward or backwards to the specified statement number.

50 GOTO 10

When the interpreter executes this statement it will jump back up the program to statement 10 and continue its processing from statement 10.

Again, the statement number following the GOTO can be an expression.

20 GOTO A*2

Will jump to the statement number calculated from the expression A*2. If the expression gives a non existent statement number the BASIC will give an error report.

Using a simple expression for a GOTO is useful where different routines may be required as a result of an input.

Another method of using a computed GOTO is to use the array variable and index it.

10 LET @(1)=100, @(2)=200, @(3)=100, @(4)=25
20 INPUT I
30 GOTO @(I)

If the input for I is 1 the interpreter will jump to statement 100
for I=2 it will jump to 200
for I=3 to 100 again
for I=4 to 25

It is advisable when using the computed GOTO to check the variable for valid values, ie in the above example it would be advisable to insert

25 IF I <1 GOTO 20
27 IF I >4 GOTO 20

This will only allow an input of 1 to 4, any other input will result in a repeat request for input.

Gosub and return

The GOSUB command although similar to the GOTO command, is used to exit from a statement and jump to a routine starting at the specified statement number. Execution continues from the specified statement number until a RETURN command where upon the BASIC returns to the command following the original GOSUB.

10 PRINT 'LETS EXECUTE ROUTINE 100'
20 GOSUB 100; PRINT 'WE HAVE NOW RETURNED'
30 STOP
100 PRINT 'THIS IS ROUTINE 100'
120 PRINT 'I WILL RETURN WHEN I HAVE FINISHED'
130 RETURN

This will result in the following printout
LETS EXECUTE ROUTINE 100
THIS IS ROUTINE 100
I WILL RETURN WHEN I HAVE FINISHED
WE HAVE NOW RETURNED

The GOSUB 100 command causes the BASIC to jump to statement 100 but also to remember where it is in statement 20. It now executes from statement 100 until it reaches the RETURN command. It then returns to statement 20 and continues processing it.

For and next commands

The FOR command is a very powerful command. It is used to make the BASIC interpreter loop 'FOR' a specified number of times, the end of the loop being defined by the NEXT command.

10 FOR I=2 TO 10 STEP 2
20 PRINT I
30 NEXT I

I is set to 2 when the FOR statement is first encountered. It will then remain at 2 until the NEXT command is encountered. On reaching the NEXT command 2 is added to I and the BASIC returns to the command following the FOR command. This is repeated until I becomes greater than 10 where upon execution continues with the command following the NEXT command.

Hence, the machine will print
2
4
6
8
10

On exit from the loop I remains at its next value ie 12.
If statement 10 had been
10 FOR I=2 TO 11 STEP 2
I will be left at its first value greater than 11 ie 12.

Negative indexing is allowed as long as the first value is greater than or equal to the second and the step is negative.

10 FOR I=10 TO 1 STEP —1
50 NEXT I

I will start at 10 and step down to 1 in increments of 1.

If STEP is omitted, a step of 1 is assumed.

10 FOR I=1 TO 100

I will start at 1 and step up to 100 in increments of 1.

Once more, expressions can be used in all three positions instead of numbers. The expressions are evaluated when the FOR command is executed and any following changes to the variables used will not effect the loop.

10 LET I=10
20 FOR I=I TO I+5
50 NEXT I

The initial value of I is evaluated as 10, the final value is 15. Within the loop, I will index from 10 to 15 in steps of 1

FOR and NEXT commands can be 'nested' within each other, the limit being that of the size of the stack.

10 FOR I=1 TO 10
20 FOR J=1 TO 5
30 PRINT I*J
40 NEXT J
50 NEXT I

This will result in the machine printing I*J when
I=1 and J=1 2 3 4 5 then
for I=2 and J=1 to 5
etc. etc.
until I=10

When a NEXT command is executed, the BASIC interpreter checks that the variable specified is the same as that used by the most recent FOR. If they are not the same, the FOR is terminated and the previous FOR examined. This continues until a match is found.

10 FOR I=1 TO 10
20 FOR J=1 TO 10
30 IF J=5 GOTO 50
40 NEXZ J
50 NEXT I

Each time J gets to 5, the BASIC jumps to statement

50. This cancels the J FOR loop leaving J at 5 and continues with the I for loop.

If within a FOR loop, another FOR loop using the same variable is encountered, the first FOR loop is terminated.

Stop

The stop commands stops the execution of the programme when it is executed. Any number of STOP commands can be included within a programme.

```
10 GOSUB 100
20 GOSUB 200
30 GOSUB 300
40 STOP
```

VDU

The VDU command allows the programmer direct access to the VDU control chip and its memory hence allowing a wide range of graphics applications.

The VDU command has two parameters, the first being the VDU memory address, the second being the desired graphic symbol specified as a decimal number.

```
10 VDU 5, 126
```

This will result in the graphic —> being placed in the fifth byte of the VDU memory.

The VDU memory is arranged as 16 rows each containing 64 bytes therefore addresses 1 to 64 are on the first row, 65 to 128 on the second etc.

Due to the function of the VDU control chip, care should be taken when using the first row and the first column as certain graphics characters will produce strange effects.

To allow the programmer to use all the VDU control commands, address zero has been allocated.

```
10 VDU 0, 12
```

This does not use memory location zero, instead the value 12 is output to the VDU controller.

12 is the command to clear the screen and reset the cursor.

Note that commands 12 and 28 require an extra delay while the command is executed. A FOR loop should be used (FOR I=1 TO 150; NEXT I before the next PRINT, VDU or INPUT command.

Other useful VDU commands are as follows:

8	Backspace cursor one character
9	Forward space cursor one character
10	Line Feed (Move cursor down on line)
11	Move cursor up one line
12	Reset cursor to top and clear screen
13	Carriage Return — Reset cursor to start of line clearing rest of line
27	Line Feed
28	Reset cursor to top without screen clear
29	Reset cursor to start of line without rest of line clear.

When using the memory mapping option, care must be taken to make sure that the memory address is between 1 and 1024 inclusive. If you exceed 1024 it is possible to overwrite the stack and your programme.

It is possible to make your BASIC programme modify itself using VDU but this is fairly difficult and not really worth the trouble it can cause.

Before using memory mapping it is advisable to use either command 12 or 28 to reset the cursor. If the screen has been scrolling, row 1 will not be at the top of the scan unless this is done.

The graphic symbol specified in the second parameter is a decimal number between 0 and 255 inclusive. If a larger number is specified, only the least significant byte is used.

The graphics and character code are given elsewhere in ETI but some of the more useful are listed below.

0 to 31	see Graphic Font
32 Space	
33 — 47	! " ≠ $ % & ' () * + , — . /
48 — 57	0 to 9
58 — 64	: ; < = >? @
65 — 90	A to Z
91 — 95	[ ]
96 — 127	see Graphics Font
128 — 225	Is a repeat of 0 to 127 (The high order bit is ignored)

To print a variable between 0 and 9 using VDU just add 48.

```
VDU 0, I + 48
```

This will print the value of I if it lies between 0 and 9.

To produce moving graphics, it is necessary to use FOR loops to index the memory mapping.

Direct commands

The following are direct commands to the BASIC Interpreter. They are obeyed as soon as they are entered.

RUN will start the execution of the programme at the lowest statement number.

LIST will print out all statement in ascending numerical order.

LIST 100 will print out all the statements starting at statement 100.

LIST 50, 10 will print 10 lines starting at statement 10.

NEW will delete all programme statements ready for a new programme.

Control C will return you (at any time) to the Monitor.

Any BASIC command can be entered as a Direct Command by leaving off the statement number. The statement is then executed immediately and not stored as part of the programme.

This feature is very useful when your programme stops due to an error report. (see Error Reports)

Abbreviations

All the commands can be abbreviated as follows.

It is advisable only to abbreviate when you are tight on memory as the abbreviated programme can be extremely difficult to follow.

Functions

A.	= ABS
R.	= RND
S.	= SIZE

Commands

Implied	= LET ie A=B+C, D=E+F etc

BASIC

REM.	= REMARK
P.	= PRINT
IN.	= INPUT
I.	= IF
G.	= GOTO
GOS.	= GOSUB
R.	= RETURN
F.	= FOR
TO.	= TO
S	= STEP
N.	= NEXT
S.	= STOP
V.	= VDU

Direct Commands

L.	= LIST
R.	= RUN
N.	= NEW

Error Reports

It is quite probable that you can have already seen some of the error reports generated by the BASIC Interpreter.

Although there are only three different error messages (WHAT? HOW? and SORRY) the BASIC will insert a question mark at the point where the error occurred.

WHAT? This means the interpreter has come across a command or expression that it can't interpret.

WHAT?
300 I? PUT A — INPUT is spelt wrongly.
WHAT?
40 A = 300/(B+C? — The close parenthesis is missing

HOW? This means the interpreter can not execute the command.

HOW?
60 A = 300*500? — The result is greater than 32767
10 A=5,B=0
20 C=A/B?
HOW? — You can't divide by zero
40 GOTO 37?
HOW? — Statement 37 is missing

SORRY This means that there is not enough memory. This can occur during typing in a programme or during the execution when the array is used — @( ). It is worth checking the variable or expression if the array is involved to make sure that it is a sensible value.

210 A = @(I*J+K)
SORRY

If this occurred during typing in of the programme then there is not enough memory.

If this occurred during execution (RUN) then either there is not enough memory for @ or the expression I*J+K may be incorrect.

To check this type
PRINT I,J,K,I*J+K
and the values of I J K and I*J+K will be printed. You can now check if the result is correct.

This shows how useful the direct command option is. If the result of the PRINT is OK then another check is
PRINT SIZE
This will give how much memory space (in bytes) is left.

CTI

NASCOM I MICRO-COMPUTER for the HOBBYIST

As reviewed in this issue

THE ONLY **COMPLETE** MICRO-COMPUTER AVAILABLE TO THE HOME CONSTRUCTOR

FEATURES

- ★ Supplied in kit form for self-assembly
- ★ Full documentation supplied
- ★ Fully screened double-sided plated through hole printed circuit board
- ★ Full 48 key keyboard included
- ★ 2K x 8 Ram
- ★ 1K x 8 monitor program in Eprom
- ★ Powerful Mostek Z80 CPU
- ★ 16 x 48 character display interface to std un-modified T.V.
- ★ T.V. display memory mapped for high speed access
- ★ On board expansion to 2K x 8 Eprom
- ★ On board expansion for additional 16 I/O lines
- ★ Memory may be expanded to full 60K (plus 4K existing on board)

SOFTWARE FEATURES

- ★ 1K x 8 monitor program providing
- ★ 8 operating commands, supporting Mem examine/modify, tabulate, copy, break, single step execute tape, load, tape dump.
- ★ Reflective monitor addressing for flexible monitor expansion through user programs
- ★ Monitor sub-routines include — delay ASCII coding, binary to hex conversion, clr screen, scroll up, string print, cursor shift and many others.

EXPANSION

- ★ Expansion buffer board **£25.00**
- ★ Memory board, with decoders and all hardware except memory ICS .. **£35.00**
- ★ 4K dynamic memory ICS **£36.00**
- ★ 8K dynamic memory ICS **£60.00**
- ★ 16K dynamic memory ICS **£144.00**
- ★ 32K dynamic memory ICS **£250.00**
- ★ I/O board with decoders and all hardware except ICS .... **£35.00** will accept up to 3 PIOs, 1 CTC and 1 UART

NEW "B-BUG" extended monitor in 2K of EPROM. Fully software compatible with NASBUG, supporting additional features —
Full keyboard shift for all 128 characters, full cursor movement routines, Read and Write commands (fast tape load and dump), H and N commands (for inserting ASCII code directly into programme). Arith. command (for calculating relative jumps), Generate command (for automatic programme start).
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microfile

Gary Evans has found himself a new home this month and reports on a way to save money and the latest in train controlers amongst other things.

OVER THE PAST FEW months the advertising pages of ETI have seen the inclusion of a number of American firms offering a wide range of components aimed in the main at the DIY computer hobbyist. The prices of many of the goods available, when converted into pounds, make very attractive reading. The snag — and there must be one — is just how do we go about getting the things over from the States.

The procedure is not as harrowing as one might suspect. The first thing to do is to identify exactly what it is you want to buy and the exact cost in dollars of the goods plus packing. Go along to your bank with the advert and tell them exactly what you want to buy and the cost in dollars. They will prepare a dollar draft, a document which, in conjunction with a sister bank in the States, will be as good as cash to the firm supplying the components. Note that your bank account will be debited at this stage.

Now its just a matter of sending off the draft plus your order — the things should arrive in the post within the next few days.

If the firm in the States 'does a bunk' with your hard-earned greenbacks, however, getting anything back will prove very difficult if not impossible. We would let you know of any companies that we know are not honouring their orders but it would be best to place a small order to try out a firm's credibility before parting with a large amount of money.

I might mention that an advert in last month's ETI, not even I've seen this month's ad pages, from an American firm, is advertising a TR5-80 16K conversion kit with information about which jumpers to change for a good bit under £100. When you compare this to the £200 plus Tandy want in addition to the fact that with the DIY way you keep your original 4K, you can see that shopping in the States can be very profitable.

Club Together

I've had a few, not a lot, but a few replies to my 'Club Call' a couple of months ago.

In the Midlands, a group of the ACC has been having successful bi-monthly meetings for about a year — contact John Diamond at 27 Loweswater Road, Binely, Coventry. Also in the midlands is the West Midlands Computer Club which has just held its first meeting in Brierly Hill. Contact Tony Bridgewood on 021-557 6709.

Now a plea for those interested in starting a branch of the ACC in Bristol, those interested contact Rex Godby at 16 Williamson Road, Ashley Down, Bristol.

Finally the Cambridge University Processor Group (they've got very nice notepaper) which despite the name is open to everyone and holds regular meetings during term time (that's about four months out of twelve from what I hear). Tim Hopkins is the man to contact at Magdaline College, Cambridge.

In all the above cases please enclose an SAE with any letter.

News of another firm generating games — initially for — you guessed it PET — the firm plan to expand into Z80 machine code programs — NASCOM, MICROS, RM 380Z with possibly games for KIM-1.

Mini micro are at 47 Queens Road, London, N11 2QP. Their catalogue is available — again send an SAE.

Shocking Story

It was my pleasure to build up one of the Triton prototypes. Enough has been said about the machine elsewhere in this issue, I'll just add my congratulations to the designer Mike Hughes for producing a really excellent project.

Before leaving the subject you might be interested to hear of an experiment I performed with the machine. It was designed to test the Triton under extreme conditions, namely applying high voltage AC the selected components via a high resistance. Needless to say I was the high resistance and the fact that I'm telling the tale show I'm OK, the Triton hardly twitched which could not be said for me.

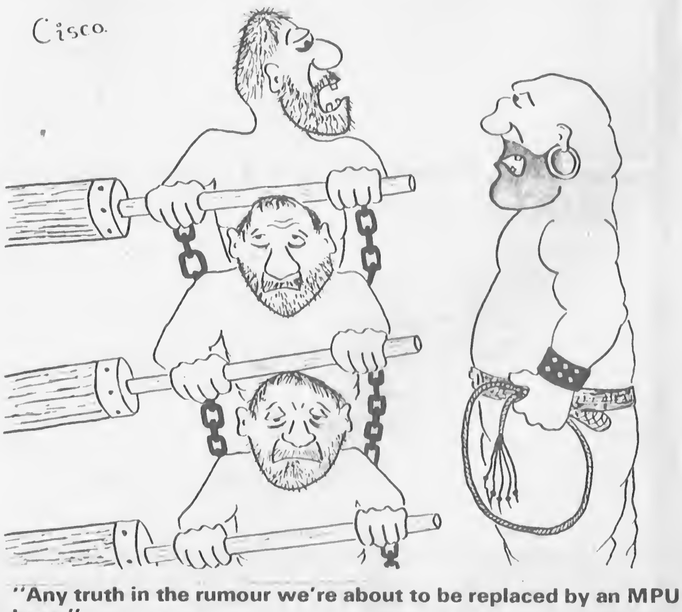
House Trained

Details are scarce, but the model train exhibition at the end of August saw the preview of an MPU controlled train system.

Designed by Hornby, who have designated it the Zero-1, the controller will enable up to 16 trains to be controlled on a layout, each being called up by a key pad. The trains will have programmable levels of inertia.

This is not a 'section' system, control being, presumably, by a pulse code system. The conversion of the train is simple, a small circuit block being inserted in the motor's power lines.

Due for launch late next year the Zero-1 should make Christmas '79 something to remember, as at a price of about £30/£40 it must be a must, to coin a phrase.



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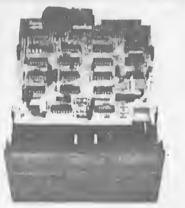

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